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IS 11465 (1985): Technical supply conditions for reciprocating air compressors for power upto 25 kW for general purpose and industrial applications [MED 22: Compressor, Blowers and Exhausters]

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(Reaffirmed 2001)

Indian Standard

TECHNICAL SUPPLY CONDITIONS FOR RECIPROCATING AIR COMPRESSOR FOR POWER UP TO 25 kW FOR GENERAL PURPOSE AND INDUSTRIAL APPLICATIONS

Compressors Sectional Committee, EDC 62; Panel for Technical Supply Conditions of Various Air Compressors, EDC 62 : P2 [Ref : Doc : EDC 62 (4148)]

1. Scope — This standard applies to single acting trunk type piston reciprocating air compressors for the general purpose industrial applications having horse power up to 25 kW meant for intermittent duty (2 000 operating hours per year) applications.

2. Terminology — For the purpose of this standard, the definitions, given in IS : 5727 - 1981 'Glossary of terms relating to compressors and exhausters (*first revision*)' shall apply.

3. Enquiry and Proposal

3.1 The purchaser shall complete the data as given in Appendix A to the extent possible and applicable, and also specify known abnormal conditions of working. In addition, purchaser may also specify any of his additional requirements.

3.2 *Proposal* — In reply to the enquiry by the purchaser, the supplier shall supply a list of all the components along with any othe details required by the purchaser.

3.2.1 The proposal shall include either a specific statement that all equipment are in strict compliance with the purchaser's specifications, or a specific list of deviations therefrom shall be furnished.

3.2.2 If required by the purchaser, the charges for deputing suppliers representative for supervision of erection shall be furnished.

3.2.3 The supplier shall furnish any special tools required for installation and maintenance work.

3.3 *Guarantee*

3.3.1 *Performance guarantee* — The compressors shall be guaranteed for satisfactory performance at the specified operating conditions. These include a guarantee for capacity and powers at the time of performance test. The tolerances to be allowed on the capacity and power consumption shall be in accordance with IS : 5456 - 1985 'Code of practice for testing of positive displacement type air compressors and exhausters (*first revision*)'.

3.3.2 *Workmanship guarantee* — All equipment, components and spare parts shall be guaranteed by the supplier against defects which despite proper use appear therein and arise from faulty design, defective or improper materials or poor and faulty workmanship. This guarantee shall be applicable for a period mutually agreed by the supplier and the user.

4. General Requirements

4.1 Parts subjected to air pressure shall have sufficient strength.

4.1.1 Design shall be such that no part of the compressor shall easily cause mechanical failure.

4.1.2 If electrical prime mover is used, proper earthing shall be ensured.

4.1.3 Every part shall have the interchangeability and shall be so constructed as not to cause any change in the performance by changing a part.

4.1.4 Parts shall be manufactured to 'fits and tolerances' as per IS : 919 (Part 1) - 1963 'Recommendations for limits and fits for engineering: Part 1 General engineering (*first revision*)'.

Adopted 3 October 1985

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4.2 *Cylinder and Cylinder Head*

4.2.1 Cylinder wall and cylinder head which are directly subjected to the pressure shall have adequate wall thickness; and uniformity which is generally acceptable per practice.

4.2.2 Maximum allowable working pressure shall exceed rated discharge pressure by at least 15 percent or one bar whichever is greater but must not be lower than safety valve net pressure.

4.2.3 Cylinders shall be spaced and arranged to permit access to all openings, valves and controls.

4.2.4 Cylinder shall have cooling provision as required by service conditions.

4.3 *Piston and Connecting Rod*

4.3.1 Piston shall be carried by connecting rod small end by piston pin of adequate design.

4.3.2 Piston shall have suitable material to withstand design pressure taking into account the optimum case of operation.

4.3.3 Piston shall have sufficient number of piston rings and grooves for piston rings shall be accurately finished.

4.3.4 Piston pin shall have adequate hardness and surface finish depending upon the compressor design (whether lubricated or oilless type).

4.3.5 Connecting rod shall have suitable material with adequate strength for design operating condition.

4.3.6 Small end and big end bearings shall be in accordance with the connecting rod material selected. Depending upon the connecting rod material and whether lubricated or oilless type compressor, the bearing type may be selected.

4.4 *Crankshaft and Bearings*

4.4.1 Crankshaft shall be suitably designed and shall have suitable material with adequate strength for design operating condition.

4.4.2 Crankshaft shall be adequately supported by bearings suitably selected to meet the design operating condition.

4.4.3 Bearing shall be of plain, ball or roller type and shall be capable to withstand the shaft load for prolonged usage.

4.5 *Valve and Filters*

4.5.1 Double stage compressors shall be provided with a safety valve at the suction side of the second stage cylinder to prevent abnormal pressure rising and to ensure the safety of the unit.

4.5.2 Suitably designed suction and delivery valves shall be used, so that they operate smoothly, free from counter flows of the air, failures and resting.

4.5.3 The valve and valve part design shall be such that no inlet valve shall be fitted instead of a discharge valve and *vice-versa*.

4.5.4 Safety valve shall be free from rusting, disorder, etc, even when they had not been in use for a long period.

4.5.5 Suction filters shall be selected such that they offer minimum resistance to suction and shall be effective for dust prevention.

4.6 *Intercoolers* — Double or multi-stage compressors shall be so constructed that heat generated in the first stage cylinder shall be discharged and the compressed air temperature shall be reduced, by installing an intercooler between successive stages.

4.7 *Frame* — Shall be designed such that it offers maximum sturdiness, hence low level of vibration. In the case of lubricated frame, the frame shall have adequate size of oil sump capacity to meet the need of maximum design condition, which also offers good surface area for cooling of sump oil. In the case of totally oilless compressor the crankcase need not have the oil sump in frame but shall be sturdy enough for keeping compressor vibration level to minimum and offer better air cooling.

4.8 *Lubrication System* — Shall be provided such that it satisfies the need for compressors maximum design condition and lubricates adequately the crankshaft, journals, bearings, cylinder walls, etc. The method of lubrication may be by a splash or by a positive pressure.

4.8.1 *Lubricating oils or greases* — Shall be selected depending upon the compressor design needs, which, as far as possible, shall be readily available.

4.9 *Piston Rings and Oil Wiper Rings (for Lubricated Cylinder Compressors)*

4.9.1 *Piston rings* — Shall be provided such that they compress the air effectively and offer minimum of rubbing resistance.

4.9.2 *Oil wiper rings* — Shall be provided such that they adequately wipe oil from cylinder walls and allow minimal of oil carryover with the discharge air.

4.10 *Piston Rings and Wear Bands (for Oilless Cylinder Compressors)*

4.10.1 Piston rings of adequate size and design shall be provided so that they compress the air effectively. Also, since it is for an oilless application, the material shall be suitably selected to meet this special requirement. The filler material for piston rings shall be suitably selected to give longer period of compressor running and better heat dissipation.

4.10.2 *Wear bands* — Of adequate size and design shall be provided on piston to ensure its proper running within cylinder and avoid metal-to-metal contact. Its material shall be suitably selected to meet the special need for air to be oilless and along with this the filler material shall also be suitably selected to give better life and heat dissipation.

5. Prime Mover and Drive Equipment

5.1 The supplier shall specify in the enquiry the type of prime mover required, for example, electric motors, diesel engine, etc.

5.2 The drive may be through gear box, belt or directly connected as appropriate.

5.3 *Prime Mover* — In case the prime mover is required to be supplied along with the compressor, the purchaser shall specify in his enquiry the technical data required for the prime mover design (type of motor, electrical supply characteristics, type of engine, etc) and also the standard or code to which the prime mover shall conform.

5.4 The rated power of the prime mover shall be higher by at least 10 percent under any operating conditions (maximum power includes shaft power or brake power plus all transmission losses).

Note — This clause includes any required tolerance on capacity and power consumption as per **IS : 5456.**

5.5 The prime mover shall be capable of taking an overload of 5 percent above normal rating as specified in **5.4**. This is to allow for any incidental running up to safety valve set pressure.

5.6 The prime mover shall have sufficient starting torque so as to be capable of starting the compressor from a stopped condition and running, it up to full speed taking into account the view that the compressor commences discharging against the rated discharge pressure from start up.

5.7 When the prime mover is to be procured by the purchaser, the supplier shall furnish the following data:

a) Compressor and transmission starting torque characteristics,

b) Inertia valve (GD2), and

c) Mounting or coupling details or both.

5.8 In case of engine drives, they shall be provided with an over-speed shut down device capable of being manually tripped and re-set. The over-speed trip shall be such as to pervent for running at a speed greater than the maximum allowable speed.

6. Auxiliary Equipment and Safety Devices

6.1 *Receivers*

6.1.1 Maximum working pressure of air receiver shall be higher than the rated pressure of the compressors.

6.1.2 Air receiver shall be of circular shape and the end plates shall be of dished end, with sufficient strength. Air receivers shall be as per IS : 7938-1976 'Air receivers for compressed air installations' or to any other related standard.

6.1.3 Air receivers upon which equipment such as compressors are mounted shall be capable to withstand the stresses due to weight, starting and stopping of the machine.

6.2 *Couplings, Reduction Gears and Guards*

6.2.1 *Couplings* — Where a coupling is provided, it shall be suitable for the power transmitted. The coupling shall conform to IS : 2693-1980 'Bush type flexible coupling for power transmission (*first revision*)'. Any coupling other than that covered by IS : 2693-1980 shall also be acceptable, as mutually agreed by the supplier and the purchaser.

6.2.2 Replacement of wearing parts of the coupling shall be possible without disturbing driver shaft or other main drive component from the system.

6.2.3 Coupling shall be suitable for expansion and any other movement of the shaft.

6.3 *Reduction Gears*

6.3.1 Reduction gear shall be suitable for power transmission on continuous operation basis for maximum shaft power of the compressor.

6.3.2 Gears shall be of suitable design and make.

6.4 *Guards*

6.4.1 Guards shall be of removable type provided on all movable parts which is considered to be hazardous to operating personnel.

6.4.2 If guards are not easily removable type, opening, if necessary with covers or suitable mechanism shall be provided to have access for any part requiring attention.

6.4.3 When V - belt driven compressor is considered, the V - belts shall be selected to transmit maximum shaft power of the compressor. The V - belt drive design shall also be suitable for same, and appropriately be provided with the guard. The slide rails used under motor for taking up belt slackness (after some running of unit) shall be selected such that it provides enough room for tightening.

6.5 *Piping*

6.5.1 The pipe work required with the compressor when given as package (with receiver or with base plate) consists of:

a) Air piping for interstage and final discharge,

b) Auxiliary pipe work — Lubricating (depending upon compressor design) cooling water, drain and vent and instrument air piping.

6.5.2 The scope of supply of pipe work by the supplier shall be properly defined with terminal points clearly fixed. The supplier shall supply all pipe work to inter-connected items of his supply reducing the number of terminal points for the purchasers connection, to a minimum when the scope of supply shall be as mutually agreed upon.

6.5.3 Auxiliary pipe work, that is, lubricating oil, cooling water, drain and vent and instrument air shall be suitably fixed on the package.

6.5.4 Unless otherwise specified the supplier shall supply the pipe work as mutually agreed.

6.6 *Safety Devices*

6.6.1 Compressor shall have mechanical unloading device (centrifugal unloaders) or any other suitably designed device so that at starting of the compressor starts on no-load condition. When the motor picks up its full speed only then the compressor begins to develop set pressure.

6.6.2 Pressure switches shall be so fitted as to be operated against the static pressure of the air receiver. The operations shall be accurate, their contact points shall not be easily damaged. Generally this is given when automatic start/stop is required.

6.6.3 Automatic governor for unloaders shall be so fitted as to be operated against the static pressure of the air receiver and accurately operated when reached to the operating pressure. Also the pressure in the air receiver shall not rise when the air inlet valve is closed. Their operations shall be accurately restorted when reached to the recharging pressure. Generally this is given when constant speed control is required.

6.6.4 *Safety valve* — Shall be provided on interstage manifold for multistage compressor. In case when more than two stages, each interstage shall have suitable safety valve. When the air receiver is provided it shall be fitted with a suitable safety valve.

6.6.5 For compressor crankcase oil level, a low oil level switch may be provided, if customer desires.

7. Controls and Instrumentation

7.1 *Controls*

a) Automatic start/stop mode of operations: Makes or breaks electric contact to the motor at pre-determined pressures. This type of regulation is used when the demand of air is small or intermittent, but where pressure shall be continuously maintained.

b) Constant speed mode of operations: Unloads the compressor at a pre-determined pressure while the motor continues to operate. This type of regulation is used when the demand for air shall be practically constant at the capacity of the compressor.

c) Dual control permits a manual selection between constant speed control and automatic start and stop control, depending upon the air requirements.

7.2 *Instrumentation*

7.2.1 For multistage compressor, pressure gauges shall be provided on each inerstages manifold and for final air discharge pressure in the case where the compressor is air receiver mounted.

8. Name Plate and Rotation Mark

8.1 *Name Plate* — Shall be securely attached at an easily accessible point on the compressor and to any other major auxiliary equipment.

8.2 *Rotation Mark* — Shall be cast in or attached to major item of rotating equipment.

9. Tests on Compressors

9.1 The tests other than hydrostatic and pressure tests shall be in accordance with IS : 5456 unless otherwise specified.

9.2 Air-receivers and coolers, shall be subjected to the hydrostatic test pressure of 1·5 times the design pressure or in accordance with the specified code.

10. Preparation for Despatch

10.1 After test and inspection are completed all exposed machined surfaces shall be coated with suitable rust preventive.

10.2 Unmachined external surfaces shall be cleaned thoroughly and painted with suitable paint.

10.3 All openings shall be provided with wooden, plastic or metal closure.

11. Documentation

11.1 The following data and drawings shall be furnished by the supplier, in addition, any other documentation mutually agreed between the purchaser and the supplier before placement of the order shall be furnished.

11.1.1 Manufacturer shall provide data as required by data sheet given in **3.1**, Appendix A along with deviations and exception etc.

11.1.2 Overall arrangement drawing of the compressor, prime mover and other accessories. This drawing shall also show the following:

a) All principal dimensions, including those required for purchasers foundation and maintenance and withdrawal space.

b) Direction of rotation of drive shaft.

c) Position of foundation bolts.

11.1.3 If the prime mover is not included in the supply, the relevant data for the prime mover shall be supplied.

11.1.4 Schematic drawing of control system when required and not covered in the maintenance and operating instruction book, cooling system and outline dimensional drawing for accessories such as after coolers, instrument panel, etc. Make, type, size, etc, shall be indicated for all these accessories.

11.1.5 *Maintenance and operating instructions* — These instructions shall be such that they include cross sectional or assembly type drawings, showing all parts, torques for tightening fasteners, lubricating oil data and other instructions and guidances given for satisfactory operation of the compressor, accessories, etc.

11.1.6 Certificates of pressure vessels as per relevant code to which these are designed and manufactured shall be provided.

11.1.7 Materials certificate for material used in manufacture of compressor and all test reports for mechanical, performance tests and any other tests shall be provided.

11.1.8 Required data for ordering spare parts shall be provided.

11.1.9 The number of copies for drawings and documents shall be mutually agreed between the purchaser and the supplier.

APPENDIX A

(*Clauses* 3.1 *and* 11.1.1)

DATA SHEET CONTAINING PURCHASER'S SPECIFICATIONS

A-1. General

a) Number of units — Running/standby

b) Site —

c) Service — Continuous/Intermittent

d) Installation — Indoor/Outdoor with roof/Outdoor without roof

e) Type of driver — Electric motor/Diesel engine/Petrol engine

f) Prime mover furnished by purchaser/supplier

A-2. Required Operating Condition

a) Site data

- i) Barometric pressure
- ii) Relative humidity — Maximum
  Minimum
- iii) Ambient temperature — Maximum
  Minimum
- iv) Environmental condition — Clean/Very dusty/In any unusual corrosive atmosphere
- v) Any special electrical equipment required because of hazard
  Class Grade Division
- vi) Cooling water supply for coolers — Type of water, pressure and temperature of supply and return

b) Electrical supply characteristics (required if prime mover is a motor which has to be included)

c) Capacity required (each machine)

d) Discharge pressure, and

e) Discharge temperature required (specify only if after-cooler is required).

A-3. Capacity Control

a) For maintaining air receiver pressure at ________________ bars

This shall be done by:

- i) Suction valve unloader
- ii) ____________________ start/stop.

b) Any other requirements.

A-4. Special Requirements

a) Oilless construction

b) Maximum allowable speed (RPM)

c) Special materials

d) Type of filter for air

e) Design code for air receiver and heat exchanger

f) Standard to which prime mover shall conform, and

g) Transmission —
    V - Belt
    Flat belt
    Gear Box
    Direct drive

h) Any special type of couplings.

A-5. Scope of Supply

Prime mover,
Additional instrumentation,
Additional safety devices,
Aftercooler,

Air receiver,
Safety valves — interstage manifold, air-receiver,
Air filter,
Cooling water piping for aftercoolers,
Instrument panel,
Special tools,
Spare parts, and
Foundation plan.

A-6. Inspection and Tests

Shop Inspection required

Test to be witnessed:	Hydrostatic test, Mechanical run test, Performance test, Strip test, Run test of the prime mover. (At suppliers end).

EXPLANATORY NOTE

Alternative design may be offered provided that covers a construction which is equivalent to or otherwise in accordance with the requirements given in this standard. The proposal shall include either a specific statement that all equipment is in accordance with this standard or a specific list with explanation of any and all deviations therefrom.

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